

NASA TECH BRIEF

NASA Pasadena Office

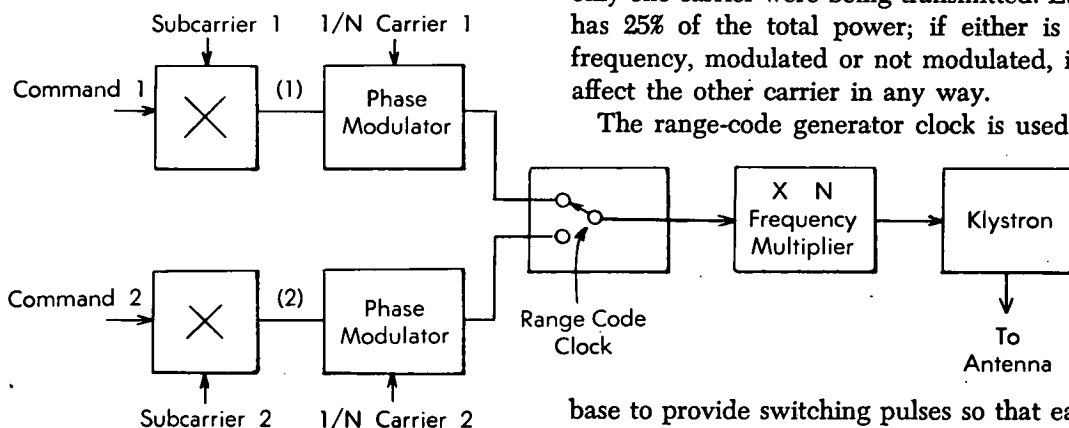


NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Two-Carrier Command Modulation System

The problem:

To transmit two high-power PCM signals from a single transmitter in such a manner that the efficiency is high, the two signals can be manipulated independently with no interference between them, and the receiver is not affected by spurious signals.



modulated by a square wave. If both signals are modulated by data-modulated subcarriers as shown in the diagram, and if the subcarrier frequencies are low compared to the switching rate, the resulting spectrum includes two carriers, each modulated by its own subcarrier and with a form exactly as though only one carrier were being transmitted. Each carrier has 25% of the total power; if either is shifted in frequency, modulated or not modulated, it does not affect the other carrier in any way.

The range-code generator clock is used as a time

The solution:

Utilize two carriers, with each phase-modulated by a subcarrier which, in turn, is modulated by data bits; switching between the two carriers is alternated at a high rate (relative to the subcarrier frequencies). The resulting composite signal is multiplied up to the desired frequency and used to drive the power amplifier (klystron) which feeds a transmitting antenna.

How it's done:

The two carriers are switched alternately to the transmitter and fed in such a way that they do not interact. Since each signal is, in effect, turned off and on at the switching frequency, each is amplitude-

base to provide switching pulses so that each carrier is transmitted 50% of the time; each carrier will have 25% of the power, and the other 50% will be in the sidebands about each carrier at the odd harmonics of the switching frequency. When it is required that a ranging code be transmitted, or that commands and a ranging code be transmitted simultaneously, the modulated command subcarrier and the ranging code are added, with the proper relative values to allocate the modulation power between them as desired, to phase-modulate the carrier. This sum of the two modulating waveforms would appear at point 1 or 2 in the diagram. The properties of the ranging code are not changed, and the spectrum of the range-code modulated carrier is essentially the same without switching.

(continued overleaf)

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP 73-10273

exclusive or exclusive license for its commercial development should be addressed to:

NASA Patent Counsel
Mail Code 1
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103

Source: Mahlon F. Easterling of
Caltech/JPL
under contract to
NASA Pasadena Office
(NPO-11548)

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-